

An Analysis of Depolarization Streaks to Anticipate Lightning in Snowfall

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JERSEY MAYHEM

NJ weather: Manchester middle school teacher struck by lightning during nor'easter

Katie Park Asbury Park Press

Published 4:59 p.m. ET March 7, 2018 | Updated 5:25 p.m. ET March 7, 2018

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WEATHER

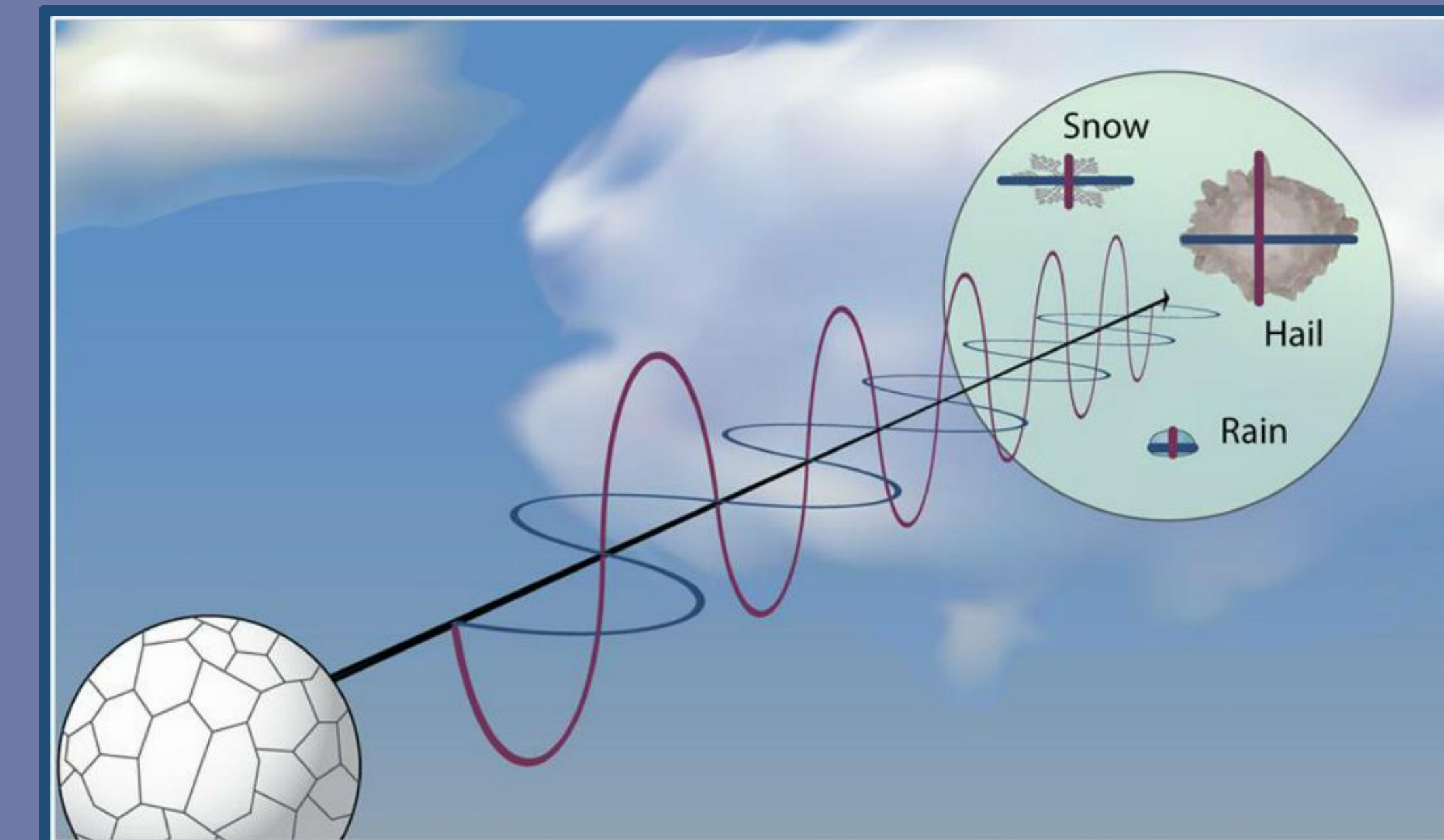
New Jersey teacher struck by lightning while on bus duty during nor'easter



Thursday, March 8, 2018

Motive

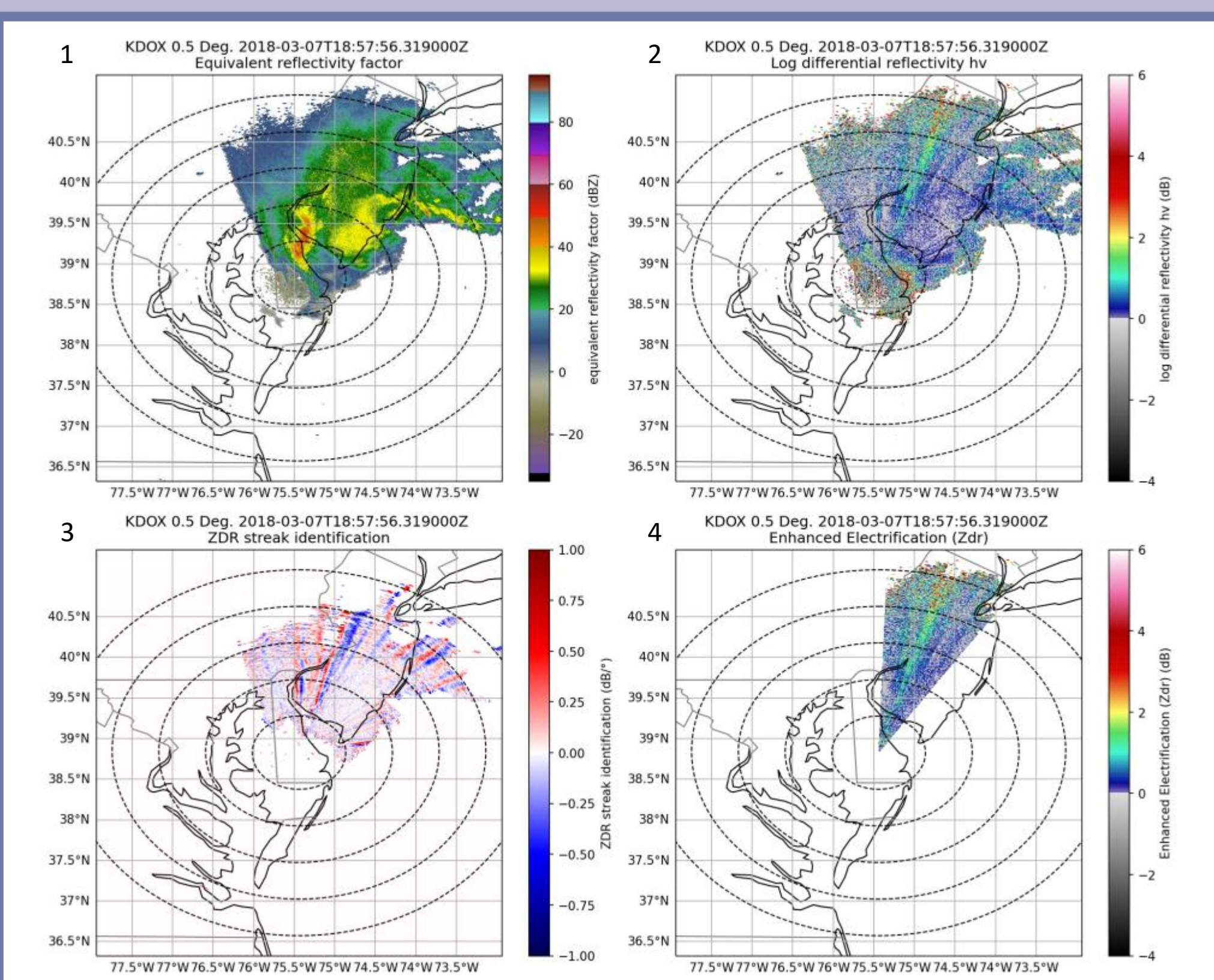
- * On March 7th 2018, a middle school teacher on bus duty was trying to help children get home during a nor'easter and was struck by lightning **in the snow**.
- * Infrequent lightning events, particularly in stratiform precipitation, present a unique decision-support challenge to National Weather Service (NWS) forecasters and core partners.
- * Anticipating thundersnow events, which are rare compared to warm season lightning, are especially difficult to anticipate due to slanted updrafts within the comma-head region of a mid-latitude cyclone.



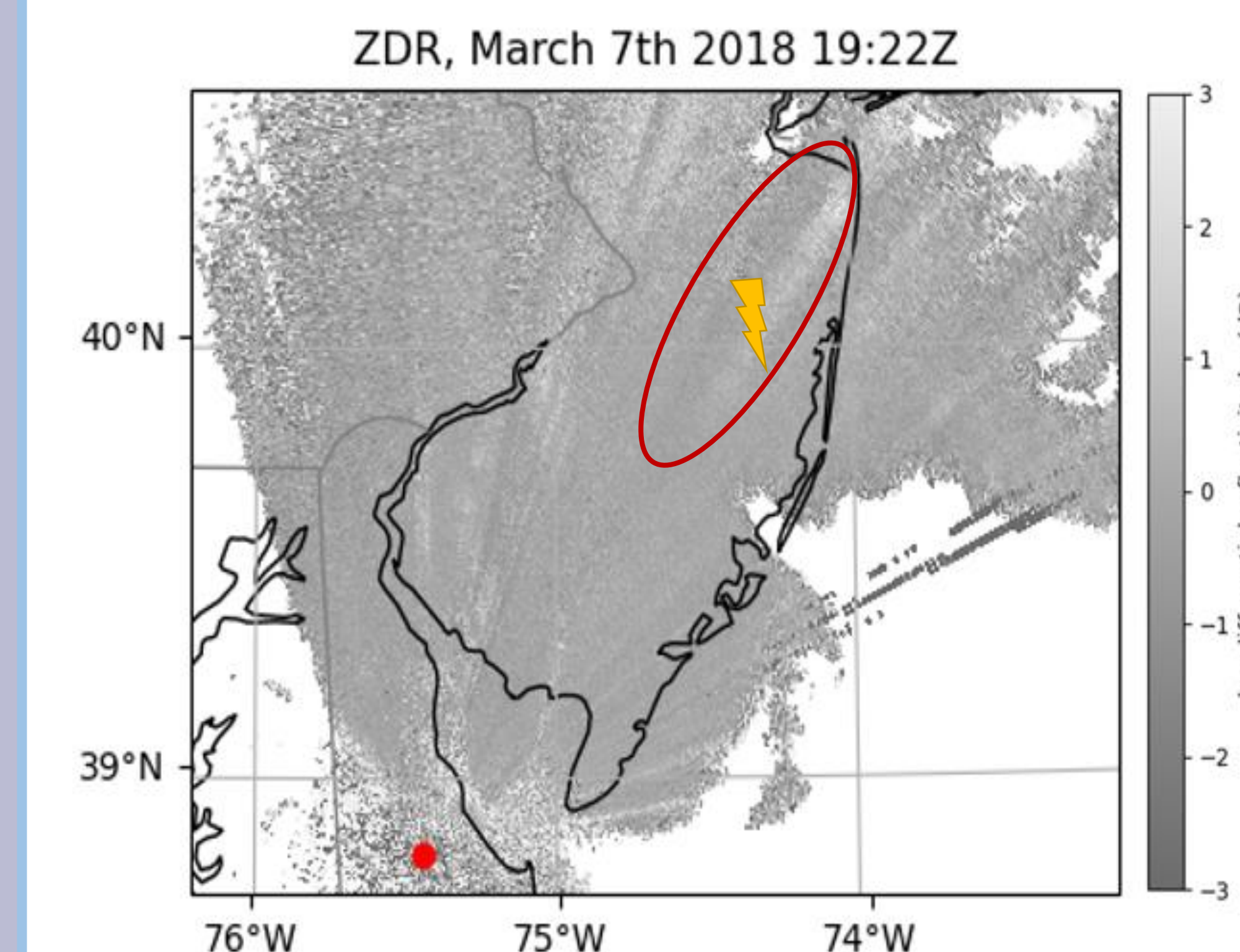
Shown above is a National Weather Service (NWS) diagram of how Dual-Polarization (Dual-Pol) radar works.

Methods

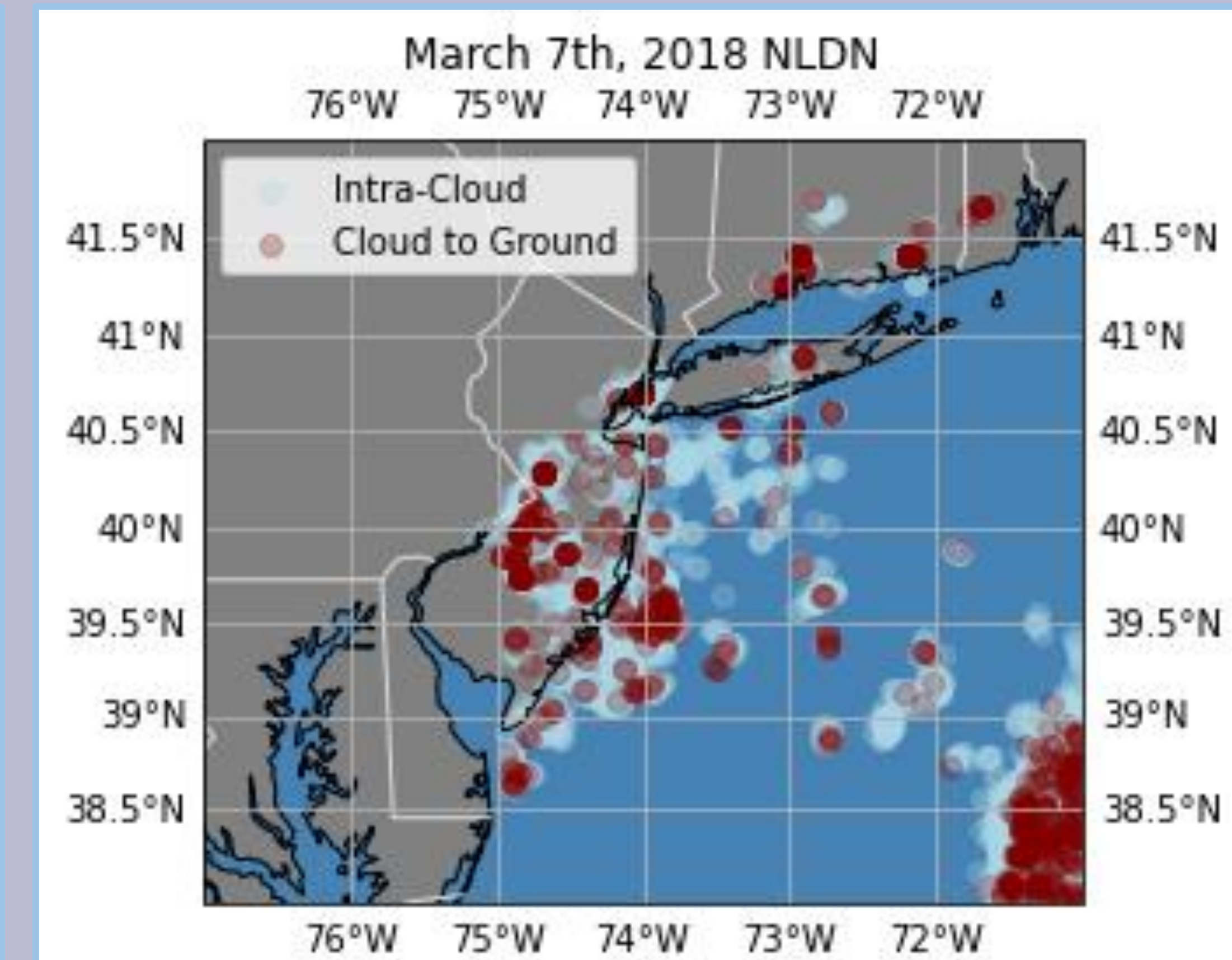
- * An algorithm written by Sebastian Harkema isolates areas with large gradients in differential reflectivity
- * Python scripts utilizing packages such as ArmPyArt, CartoPy, and MetPy are used to visualize dual-pol radar moments.
- * Visually review depolarization streak, reevaluate to determine if streak is a product of attenuation.
- * Run National Lightning Detection Network data through a python script to visualize the data, and compare with geographical information of the depolarization streak.
- * Record the depth of the depolarization streak and the time it appeared and disappeared on radar.



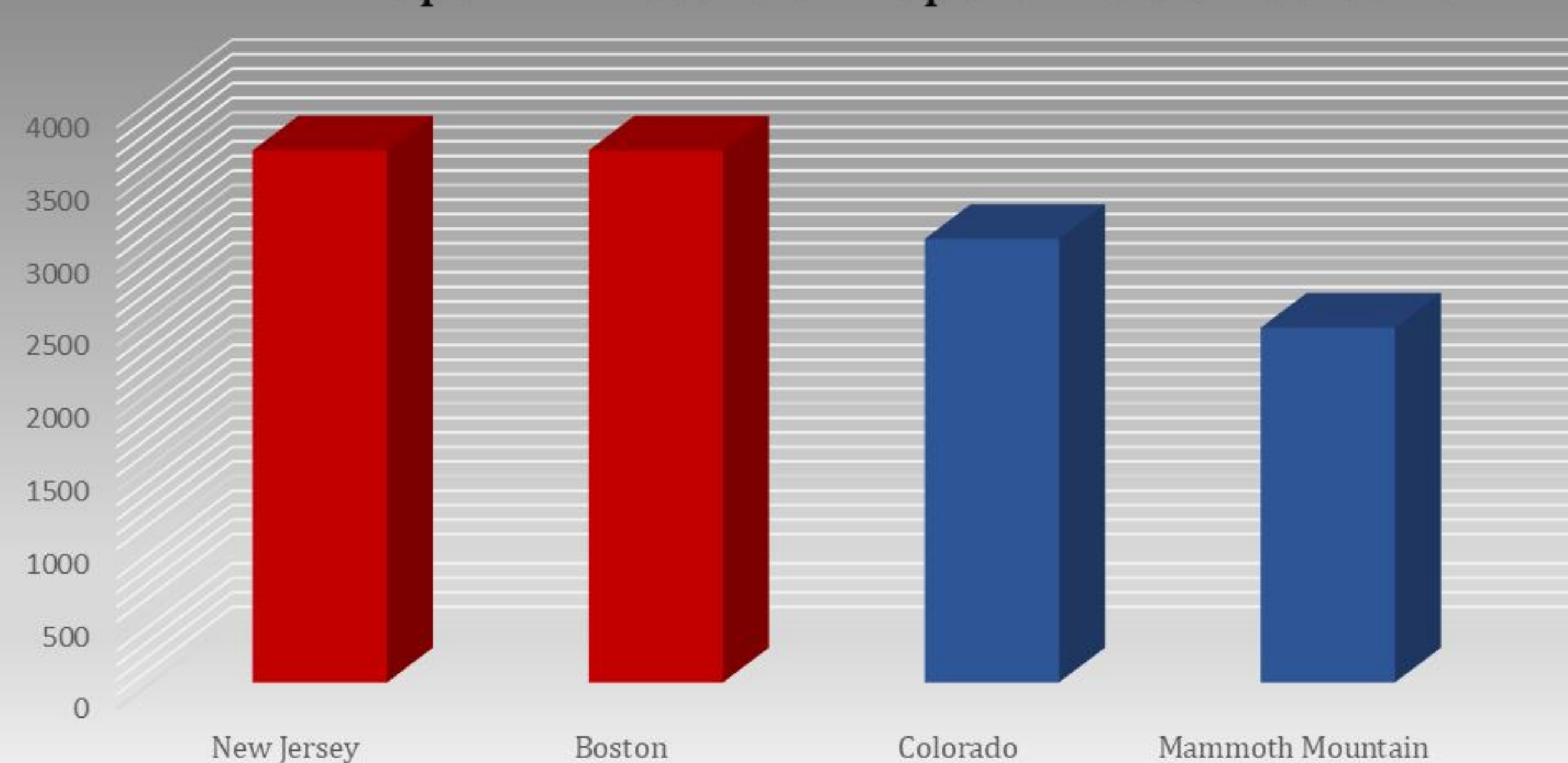
- * Shown to the left is a four-panel analysis of the same Level II NEXRAD moment using Mr. Harkema's algorithm.
- * Reflectivity is shown in image 1, Differential Reflectivity is image 2, Differential Reflectivity re-colored is image 3, and the isolated depolarization streak is image 4.
- * Charts like these are used to verify depolarization streaks and eliminate streaks caused by attenuation and beam blockage.



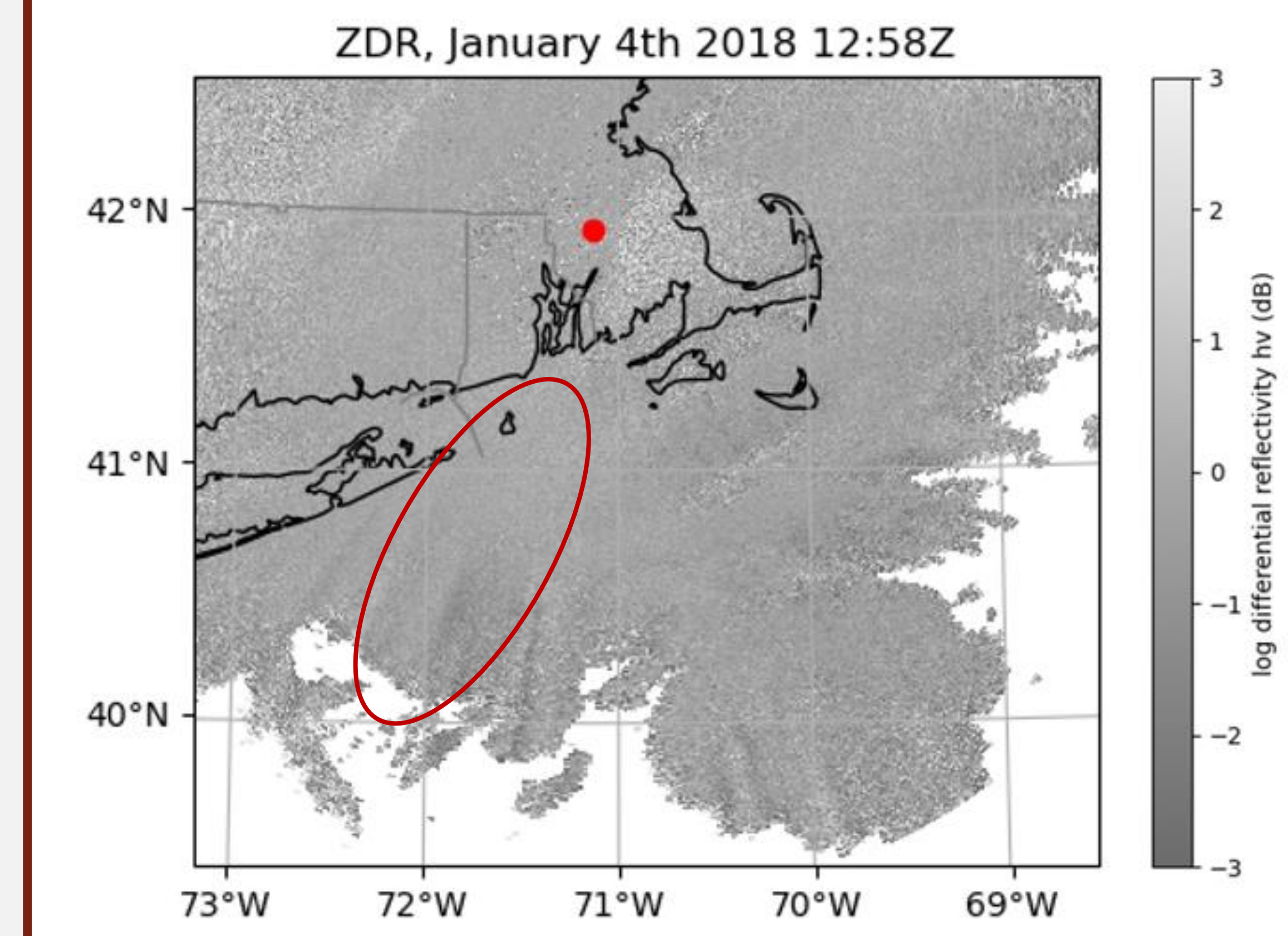
- * The image to the left displays streaks in ZDR at 0.5 degrees elevation, some due to attenuation/radar obstruction and others (circled) due to a difference in orientation of ice crystals.
- * The lightning bolt is placed where the middle school teacher was struck by lightning while helping dismiss students around 2:30pm local time.
- * To the right, National Lightning Detection Network (NLDN) data is shown and differentiated by intra-cloud (in blue) and cloud-to-ground strikes (in maroon).
- * Data for March 7th, 2018 show that the area first experienced lightning up to 6 hours after electrification was observed using streaks in ZDR.



Depth in Meters of Depolarization Streaks



Preliminary results suggest **the depth of the streak plays a role in electrification**. The cases displayed in red are cases that contain cloud-to-ground lightning observations and the cases represented in blue are cases that contained no cloud-to-ground strikes, only intra-cloud.



- * The image to the left shows the "Boston" Case from January 4th 2018 at 0.5 degrees elevation.
- * Highlighted are the depolarization streaks believed to have been associated with cloud-to-ground strikes, and the red point indicates the radar location (KBOX).
- * Displayed on the right is the NLDN data from January 4th, 2018.
- * Lightning is shown to have occurred to the south and east of Boston, Massachusetts, aligning well with detected depolarization streaks.

